PAN-PACIFIC ENTOMOLOGIST
61(4), 1985, pp. 339–344

Bees of the Genus *Megaceratina* in Equatorial Africa (Hymenoptera, Apoidea)

HOWELL V. DALY

Department of Entomological Sciences, University of California, Berkeley, California 94720.

Abstract.—New information is provided for the monotypic *Megaceratina*: synonymy, illustrations and description of male, collection records, information on geographic variation in size and color pattern, and phylogenetic relationships to the Ceratinini.

Hirashima (1971) described *Megaceratina,* with the type species *Ceratina bouyssoui* Vachal (1903), for the largest ceratinine bees in Equatorial Africa. He chose to treat the specimens available to him as members of one widespread, polymorphic species. I support his interpretation and provide new synonymy, the first complete description of the male, new collection records, information on variation, and a reinterpretation of phylogenetic relationships.

The monotypic *Megaceratina* is recognized by the large body size (forewing length 6.7–10.2 mm), unique wing venation of a slender pterostigma and long prestigma (equal to or greater than the length of the stigma proximal to vein r), genal spines on females that increase allometrically with body size, and, in both sexes, a sharp, blade-like edge ventrally on the distal half of the mid and hind femora. Except for facial marks, the bodies of both sexes may be almost entirely black or with the metasoma almost entirely red or variously marked with a pattern of orange to yellow spots. The color patterns suggest that the bees are involved in local mimetic associations with similar-sized wasps.

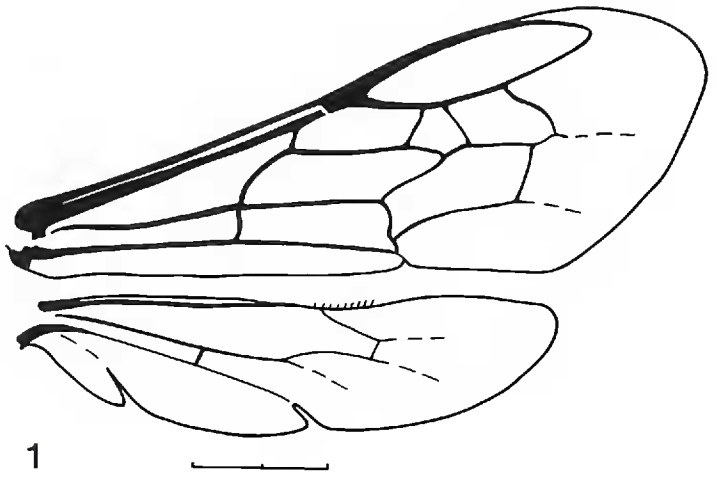
Megaceratina sculpturata (Smith), NEW COMBINATION
(Figs. 1–6)

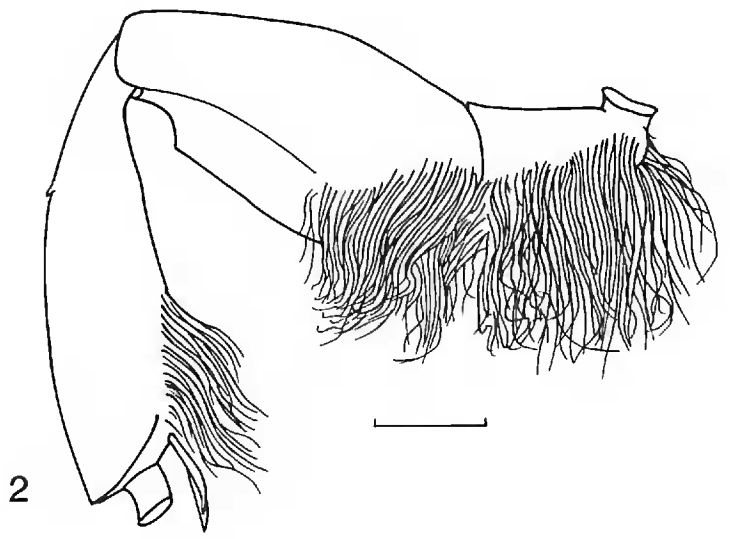
Ceratina sculpturata Smith, 1854:225 (Senegal; type is a male, not a female as originally indicated, BMNH 17B-310) (examined).

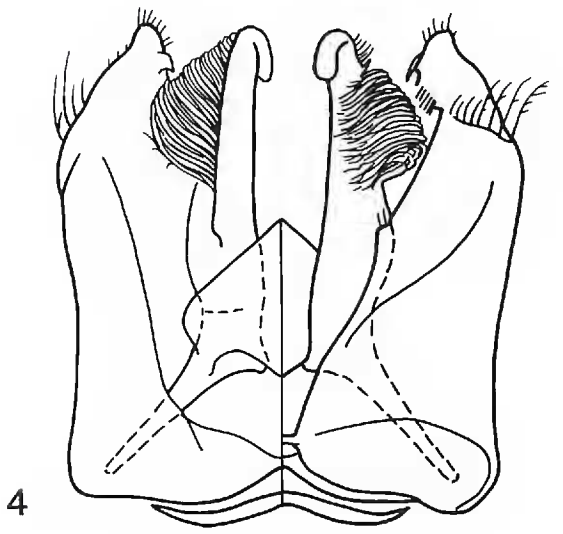
Ceratina bouyssoui Vachal, 1903:383 (Gabon, Lambarene; lectotype female designated by Daly, 1973:385; MNHN) (examined). Syn. n.

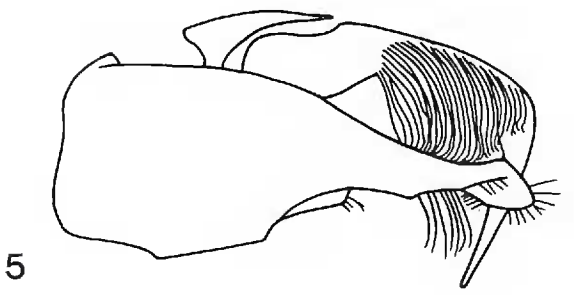
Ceratina ruficauda Cockerell, 1932:12 (Zaire, Malela, 6S 12.40E; holotype female, AMNH) (examined). Syn. n.

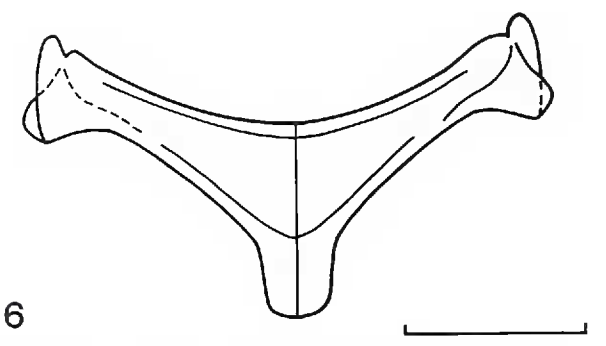
Measurements (method illustrated in Daly, 1983; except as noted, numbers are millimeters ×100).—Female (*C. bouyssoui* lectotype): wing, 9.3 mm; number of hamuli, 9; eye, 230: 245: 270: 270; clypeus, 120 × 250: 50: n.a.; interocellar, 30: 85: 65: 80, D 25; frontal carina, 95; malar area, 0 × 90; interalveolar, 50: 80: 80: 95, D 25; antenna, 110: 23: 20: 10: 15: 15, D 25. Male (*C. sculpturata* holotype):











Figures 1–6. *Megaceratina sculpturata.* 1. Wings of female, scale equals 2 mm. 2. Right hind leg of male, scale equals 0.5 mm. 3. Male metasomal sternum 6, ventral view. 4. Male genitalia, dorsal (left) and ventral (right) views. 5. Same, lateral view. 6. Male metasomal sternum 8 (dorsal and ventral views). For Figures 3–6, scale equals 0.5 mm.

wing, 6.7 mm; hamuli, 8; eye, 185: 160: 170: 165; clypeus 90 × 140: 35: 105; interocellar, 25: 50: 45: 55, D 18; frontal carina, 65; malar area, 0 × 6; interalveolar, 40: 40: 60: 70, D 20; antenna, 70: 15: 15: 7: 10: 18, D 22.

Female.—See Hirashima (1971).

Male.—Head rounded in cephalic view; inner margin of eye with deep groove just anterior to summit, inner margins slightly divergent below; frontal carina strong, inverted Y shape, arms diverging on frons below antennal bases; clypeus unmodified; lateral portion of gena unmodified; preoccipital ridge strongly carinate; hypostomal carina strong, straight edged in lateral view, with a short transverse subgenal carina attached at rear angle of hypostomal carina (corresponding to subgenal carina associated with genal spine in female); postgena at each side of proboscidial fossa and posterior to subgenal carina with a large pyriform fossa similar to acarinaria on certain other ceratinines (also in female); antennal flagellum with ventral length of segment 2 less than segment 3; mandibles tridentate;

labrum with 2 denticles on disk. Mesosoma: Dorsum of pronotum below scutum, straight, without carina, lateral angles rounded in cephalic view and not carinate; scutellum, metanotum, and propodeum in essentially one sloping plane; axillae not spined; metapleural line carinate; propodeum without carinae; lateral angles of fore coxa produced and narrowly rounded; fore and mid tibia with single dorsoapical recurved spine, fore tibia with sharp, projecting ventroapical angle; mid and hind femur with sharp ventral edge in distal half (also in female); hind tibia with small basitibial spine at basal 0.35 (position as in female). Metasoma: tergum 1 with dorsoanterior surface flattened, distinct from large anteriomedian depression and narrow, transverse, polished apex (also in female); terga 2–4 and sterna 2–3 with graduli; sterna 1–5 unmodified; small median emargination of sternum 6 with sharp, reflected edge and short admedian teeth (Fig. 3); sternum 8 (abdominal sternum 9) transverse, V shape, without pubescence (Fig. 6); tergum 7 small, truncate, unmodified; gonobase unusually short, transverse, strap-like sclerite (Fig. 4); genitalia without gonostyli, apex of gonocoxite narrowly and unevenly rounded, with small dorsal recurved hook, apex thinly pubescent, subapex with lateral plumose setae and medial stout bristles, penis valves long, slender, hook-like with blunt apex and bearing a dense dorsolateral brush of plumose setae (Figs. 4, 5). Sculpture and vestiture: impunctate areas limited to small areas as follows: subantennal area, in front of pronotal lobes, posterior ends of notauli, just lateral to spiracle on propodeum, median posterior area of propodeum, sides and disk of tergum 1. Punctation generally dense over body; large, contiguous, areolate punctures on head becoming smaller and obscured by longitudinal costae on clypeus; polygonal to round punctures, less than a puncture width apart on scutum; scutellum and metanoum with smaller, contiguous punctures; base of propodeum uniformly rugulose; mesopleuron with round punctures less than a puncture width apart; metapleuron and sides of propodeum with dense fine punctures; metasoma with small punctures anteriorly, becoming indistinct posteriorly. Pubescence general sparse except long, woolly, pale plumose setae ventrally on the following: thorax and anterior sterna, apices of all coxae, all trochanters, extending distad on basal third of mid and hind femora, and apical half of hind tibia (Fig. 2); inconspicuous, but enlarged subapical setae laterally on terga and sterna 2–5, spaced several to many seta widths apart.

Geographic distribution and variation.—*Megaceratina* is known from West and Central Africa, from 15N to 10S latitude; near sealevel along western coast from Senegal to the mouth of the Zaire River, inland to 2000 m in the Zaire basin, and reaching the easternmost record north of Lake Victoria, Uganda. Variation exists in body size, the color of both sexes and, in females, the genal spines may be only small genal carinae or massive projections with associated sculpturing. Yellow facial marks in both sexes consist of a transverse, subapical spot on the clypeus that may be divided medially in specimens with reduced marks, a spot on each side in the lower paraocular area just lateral to tentorial pit, and, in males, an additional spot on the mandible base. The head and thorax are shiny black, legs dark brown to black, wings light smoky to very dark brown, and the metasoma either essentially one color or black with a spot pattern of orange to yellow. Thus, metasomal terga and sterna 2–6 may be almost entirely red, yellow-orange, or black, or metasoma black with a light colored spot pattern: tergum 3 with a spot at each side, terga 4–5 with large lateral spots that may be separate or continuous

medially, tergum 6 almost entirely light colored or black, and sterna 5–6 with or without lateral spots.

In western Africa the bees are the smallest (forewing lengths of 2 males: 6.7–7.1 mm; of 2 females: 6.7–7.1 mm), wings smoky, face marks distinct, female metasoma either red (Gambia) or black (Ivory Coast), male abdomen largely black with obscure lateral reddish areas (Senegal), and females with no genal spines. Females from near Douala, Cameroun are the largest specimens (forewings of 2: 9.6–10.2 mm) and have very dark wings, distinct face marks, metasoma red, and large genal spines. Further south along the coast at Lambarene, Gabon, females have dark wings (average forewings of 8: 9.05 mm, range 8.4–9.7 mm), reduced face marks, metasoma red (Ogooue) or with orange-yellow spot-pattern on terga and lateral spots on sterna 4–5, and variable genal spines. At Malela, near the mouth of the Zaire River, females have smoky wings (forewings of 2: 8.2–8.3 mm), distinct face marks, metasoma yellow-orange, and small genal spines. Inland at Eala and Bokuma on the Ruki River at the equator, females have dark wings (forewings of 2: 8.9–9.2 mm), small face marks, metasoma with orange-yellow spot pattern on terga and with black sterna, and have variable genal spines. One female from near Tororo, Uganda, has light smoky wings (forewing: 8.2 mm), small face marks, metasomal terga 3–5 with only lateral orange-yellow spots, and small genal spines. Further south in the uplands of the Zaire basin, females have dark wings (average forewings of 5: 8.6 mm, range 8.2–9.1), obscure small face marks, metasoma with yellow-orange spot pattern on terga and with faint or no spots on sterna, and variable genal spines. Two males (forewings: 7.8–8.5 mm) have the metasomal yellow-orange spot pattern on terga 2–6 or 3–6, the marks outlined in black, tergum 6 and the sterna black.

The close similarity of the male genitalia and the structure and vestiture of the hind legs of males from the extreme limits of the distribution (Senegal and Sankuru Province, Zaire) supports the hypothesis that the variable populations are one polytypic species.

Phylogenetic relationships.—Hirashima (1971) considered the long prestigma and slender pterostigma of *Megaceratina* (Fig. 1) as characters indicating an intermediate relationship between Ceratinini (typically short prestigma, wide pterostigma) and the Xylocopini (long prestigma, greatly reduced pterostigma). I suggest the similarity to the venation of Xylocopini is superficial, convergent, and not indicative of an intermediate relationship. Although unique among Ceratinini, the prestigma of *Megaceratina* is similar to that of many taxa of bees, including Euglossini, Bombini, and Apini as well as Xylocopini. The shape of the pterostigma of *Megaceratina,* however, is unique among Apoidea. The long prestigma, unique distal extension of the stigma along the radial vein, the thickening of crossvein r and the radial sector, and elongation of the marginal cell appear to be a suite of characters associated with strengthening the leading edge of the forewing. The unusual anterior venation of *Megaceratina* can be interpreted as an extreme modification of ceratinine venation that is associated with the structural demands of flight by large bees. Other large ceratinines such as *Ceratina chalcites* (average forewing of 12 males: 8.5 mm) or *Ceratina aloes* (average forewing of 10 females: 6.6 mm), have the typical short prestigma, but a more slender pterostigma of width equal 0.18–0.25 length rather than the typical width equal 0.3 length, thickened veins, and an elongated marginal cell.

Hirashima (1971) pointed out other morphological features of *Megaceratina* that show relationships to the Ceratinini. He noted the unusual red marking on the metasoma. To his comments, should be added that *Ceratina rhodura* of southern Africa has an entirely red metasoma. The presence of genal spines among distantly related ceratinines is doubtless convergent. In addition to *Ceratina laticeps,* the females of at least two other species in the Americas have genal spines: *C.* (*Zadontomerus*) *punctigena* and an unnamed species of *Crewella* from Colombia (BMNH).

Material examined.—Cameroun. Douala (4.04N, 9.43E), 14 mi E, 80 m, 2 females, 20.xi.1966 (E. S. Ross, K. Lorenzen; CAS). Gabon. Lambaren (Lambarene) (0.41S 10.13E), 7 females, x.1897 (includes lectotype of *C. bouyssoui*; Bouyssou; MNHN), 1 female, x.1897 (Bouyssou; TMP); Ogooue (River), 1 female, 1911 (R. Ellenberger; MNHN). Gambia. "Gambie," 1 female, 1 male, 1915 (J. Perez, MNHN). Ivory Coast. Grand-Bereby (4.39N 6.53W), 1 female on *Stachytarpheta angustifolia* (Mill.) Vahl., 18.xii.1979 (A. Pauly; FSAGx). Ruanda. Mt. Mbude, S. du 1. Luhondo (Lac Ruhondo, 1.30S 29.45E), 2000 m, 1 female, 29.i.1953 (P. Basilewsky; MRAC). Senegal. 1 male (holotype of *C. sculpturata*; BMNH). Uganda. Tororo (0.42S 34.12E), 22 mi W, 1 female, 28.vi.1967 (C. D. and M. H. Michener; UK). Zaire. Bas Congo, Malela, 6S 12.40E, 1 female 5.vii.1915 (holotype of *C. ruficauda*; Lang & Chapin; AMNH), 1 female, 1915 (Lang & Chapin; MRAC). Equateur, Eala (0.02N 18.22E), 1 female, vii.1935 (J. Ghesquiere; MRAC); Bokuma (0.2S 18.45E), 1 female, vii.1952 (R. P. Lootens; MRAC). Kivu, Kimbombo (4S 26E, near Kasongo; see Bequaert, 1918), 1 female, 1.xi.1910 (Bequaert; MRAC). Lomami, Kaniama (7.32S 24.11E), 2 females, 1931 (R. Massart; MRAC). Maniema, Kindu (3S 25.55E), 1 female, 1917 (L. Burgeon; MNHN). Sankuru, M'pemba Zeo (Gandajika) (6.46S 23.58E), 1 female, 12.vi.1960 (D. R. Marechal, No. 1541; MRAC), 1 male, 27.iii.1960 (D. R. Marechal, No. 1301; MRAC), 1 male, 1956 (P. de Francquen; MRAC); Mwene Ditu (7.01S 23.27E), 1 female, 25.xi.1952 (Ch. Seydel; MRAC).

Acknowledgments

I am indebted to Dr. Charles D. Michener for his constructive comments on the manuscript. Thanks go to Barbara Boole Daly who prepared the illustrations. Dr. James M. Carpenter provided help in locating a collecting site of J. Bequaert. The following persons kindly loaned specimens for study: J. Leclerq and A. Pauly, Faculté des Sciences agronomiques de l'État, Zoologie générale et Faunistique, Gembloux, Belgium (FSAGx); C. D. Michener, University of Kansas, Lawrence, Kansas (UK); G. Else, British Museum (Natural History), London (BMNH); J. G. Rozen, Jr., American Museum of Natural History, New York (AMNH); S. Kelner-Pillault, Museum National d'Historie Naturelle, Paris (MNHN); L. Vari, Transvaal Museum, Pretoria, South Africa (TMP); P. Arnaud, Jr., California Academy of Sciences, San Francisco (CAS); J. Decelle, Musee Royal de l'Afrique Centrale, Tervuren (MRAC). This research was supported in part by research grants from the National Science Foundation (GB-7933, GB-34089).

Literature Cited

Bequaert, J. 1918. A revision of the Vespidae of the Belgian Congo based on the collection of the American Museum Congo Expedition, with a list of Ethiopian diplopterous wasps. Bull. Amer. Mus. Nat. Hist., 39:1–384.

Cockerell, T. D. A. 1932. Records of African bees. I. Amer. Mus. Novitates No. 547, 16 pp.
Daly, H. V. 1973. Lectotype designations of African bees of the genus *Ceratina* and allies (Hymenoptera, Apoidea). Pan-Pac. Ent., 49:383–388.
———. 1983. Taxonomy and ecology of Ceratinini of North Africa and the Iberian Peninsula (Hymenoptera: Apoidea). Syst. Ent., 8:29–62.
Hirashima, Y. 1971. *Megaceratina,* a new genus of bees of Africa (Hymenoptera, Anthophoridae). J. Nat. Hist., 5:251–256.
Smith, F. 1854. Catalogue of Hymenopterous insects in the collection of the British Museum. Part II. Apidae. British Museum (Natural History), 199–465.
Vachal, J. 1903. Hyménoptères du Congo francais rapportés par l'ingénieur J. Bouyssou. Ann. Soc. Ent. Fr., 72:358–400.